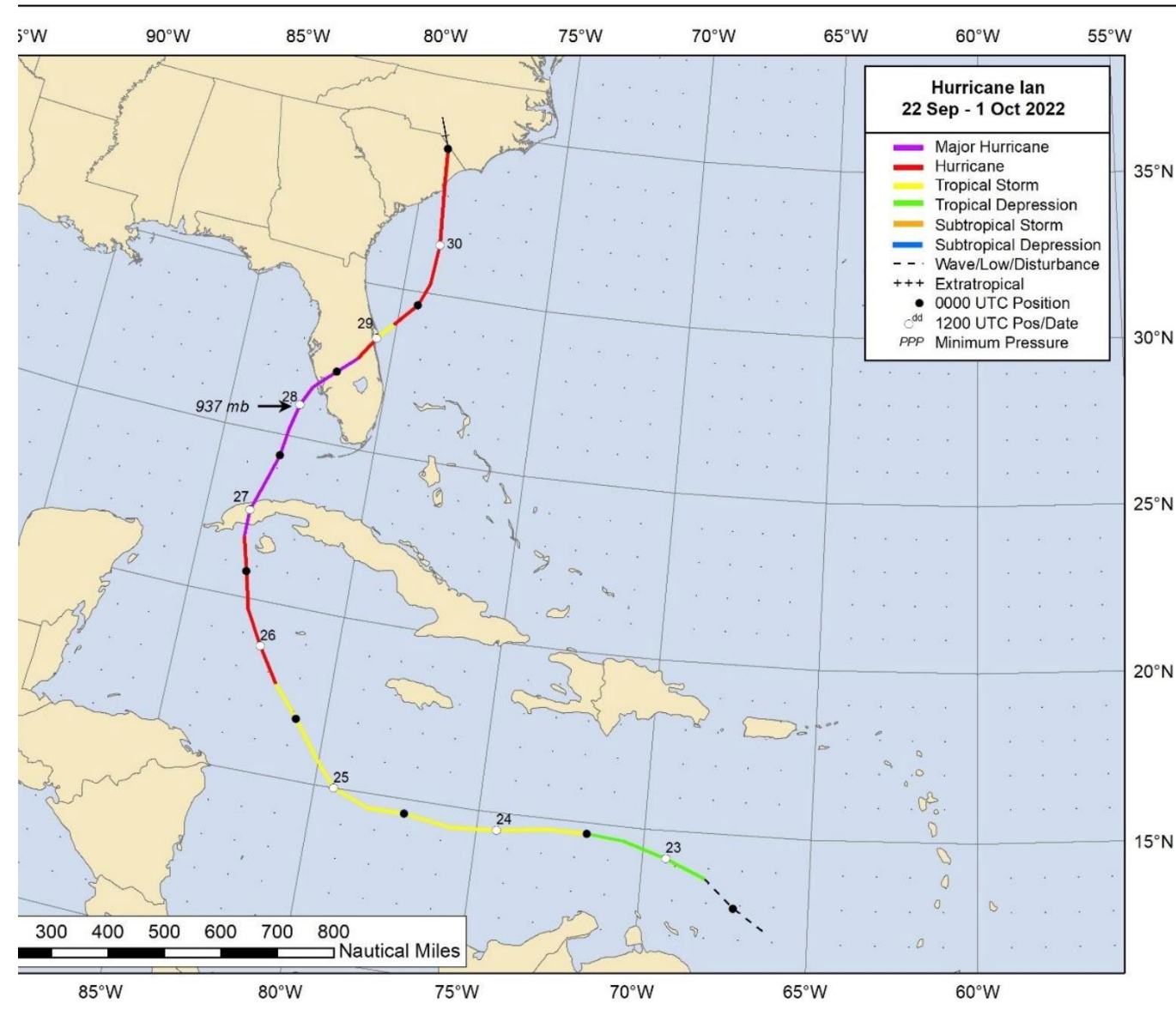


# Hurricane Ian Study

Jim LaDue

Acting Director, NWIRP

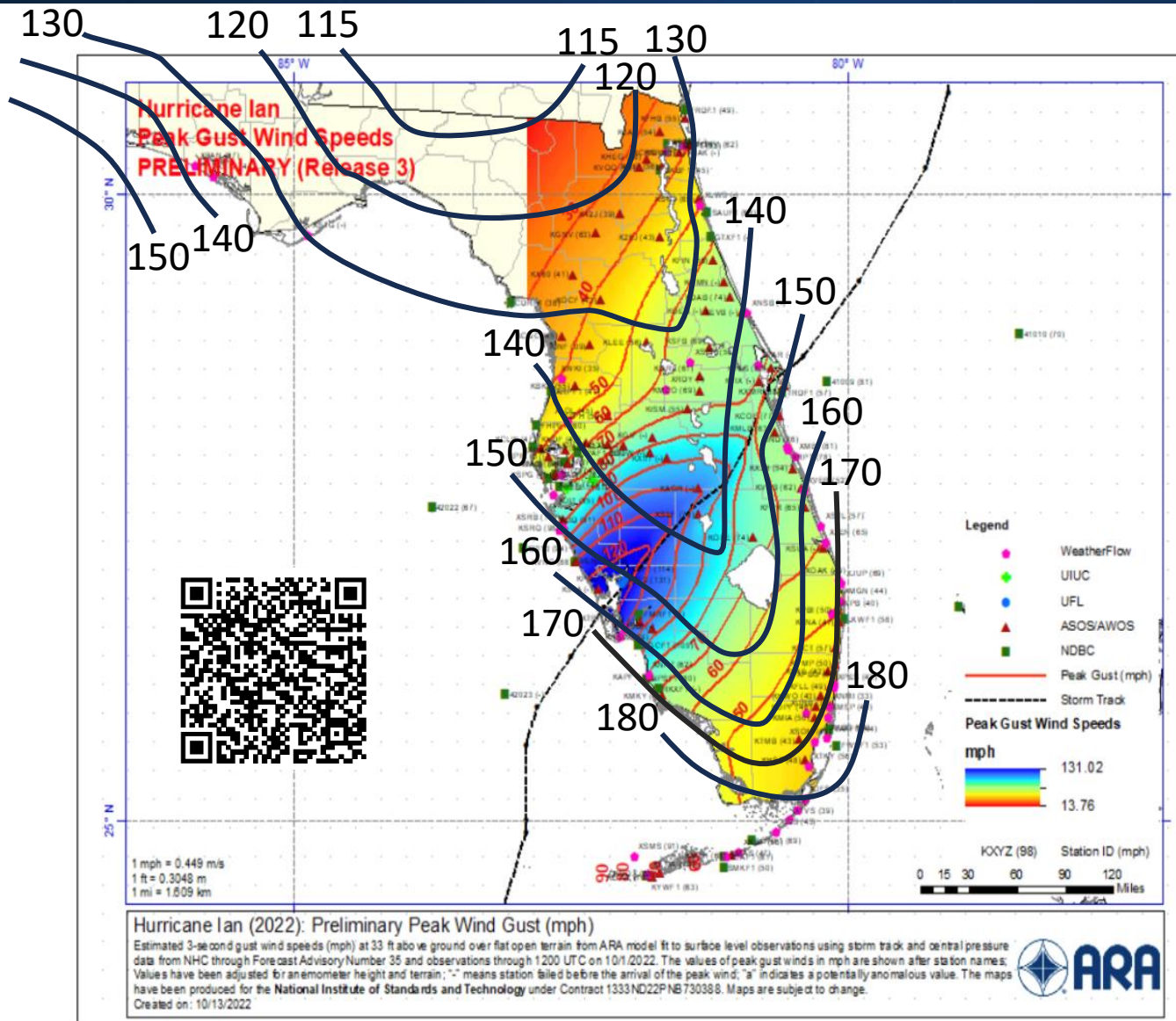
# Hurricane Ian Impacts



- **Category 4 at landfall at Cayo Costa Key**
- **156 fatalities**
  - 41 from storm surge
  - 12 from freshwater flooding
  - 4 from wind
  - 18 indirect from lack of medical services
- **\$112.9 billion total damages**
  - \$109.5 billion in Florida
  - 5,369 structures destroyed in Lee County, FL

Credit: [National Hurricane Center](https://www.nhc.noaa.gov/)

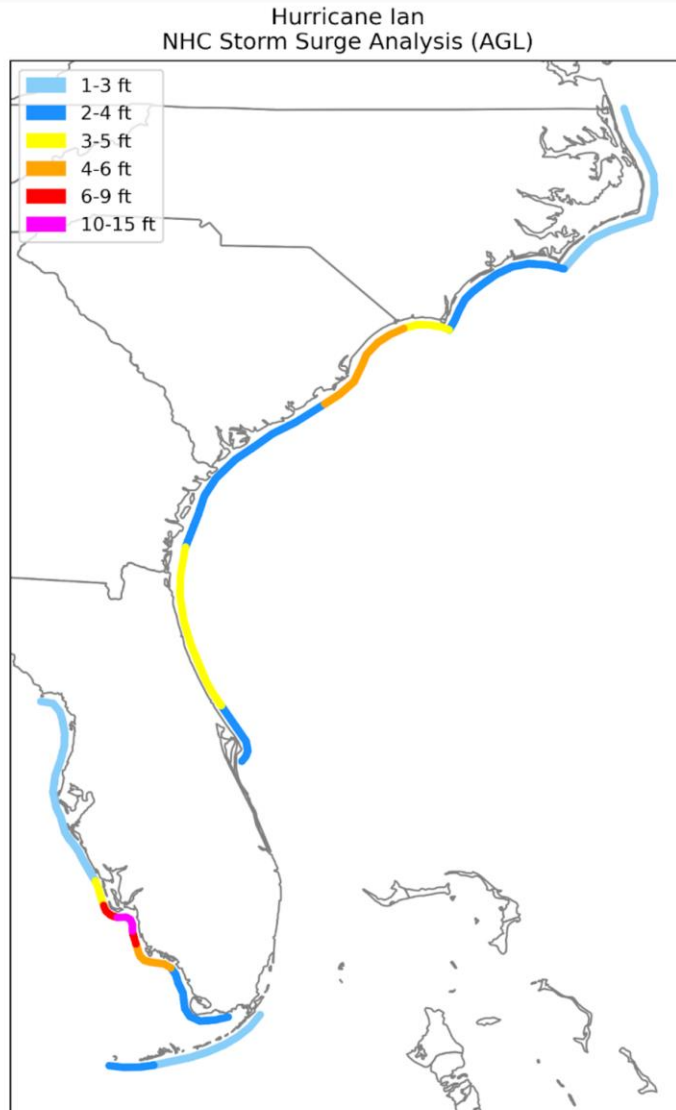
# Hurricane Ian Windfield



- Peak measured wind gust: 140 mph, Iona, FL (@ landfall).
- 111 mph @ Punta Gorda from a Florida Coastal Monitoring Program tower. (U of FL 10m AGL)
- All measured wind gusts were below design levels.



# Hurricane Ian Surge

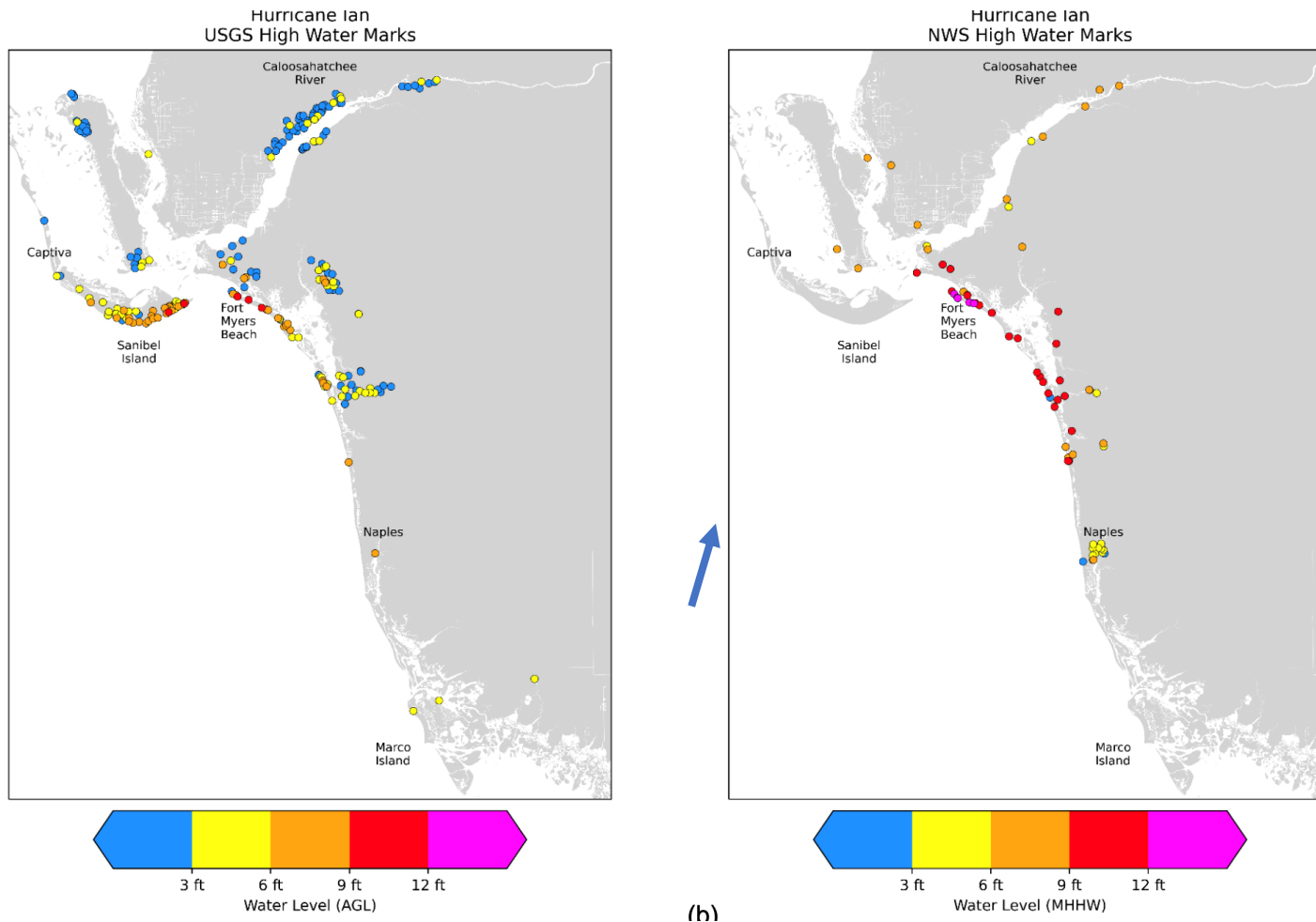


Credit: [National Hurricane Center](#)

- Widespread with two landfalls and three areas of action (SW FL, NE FL, SC and NC)
- Peak water levels in SW FL
- Largest impact on buildings and residents, similar to Ike (2008), Sandy (2012) and Katrina (2005)

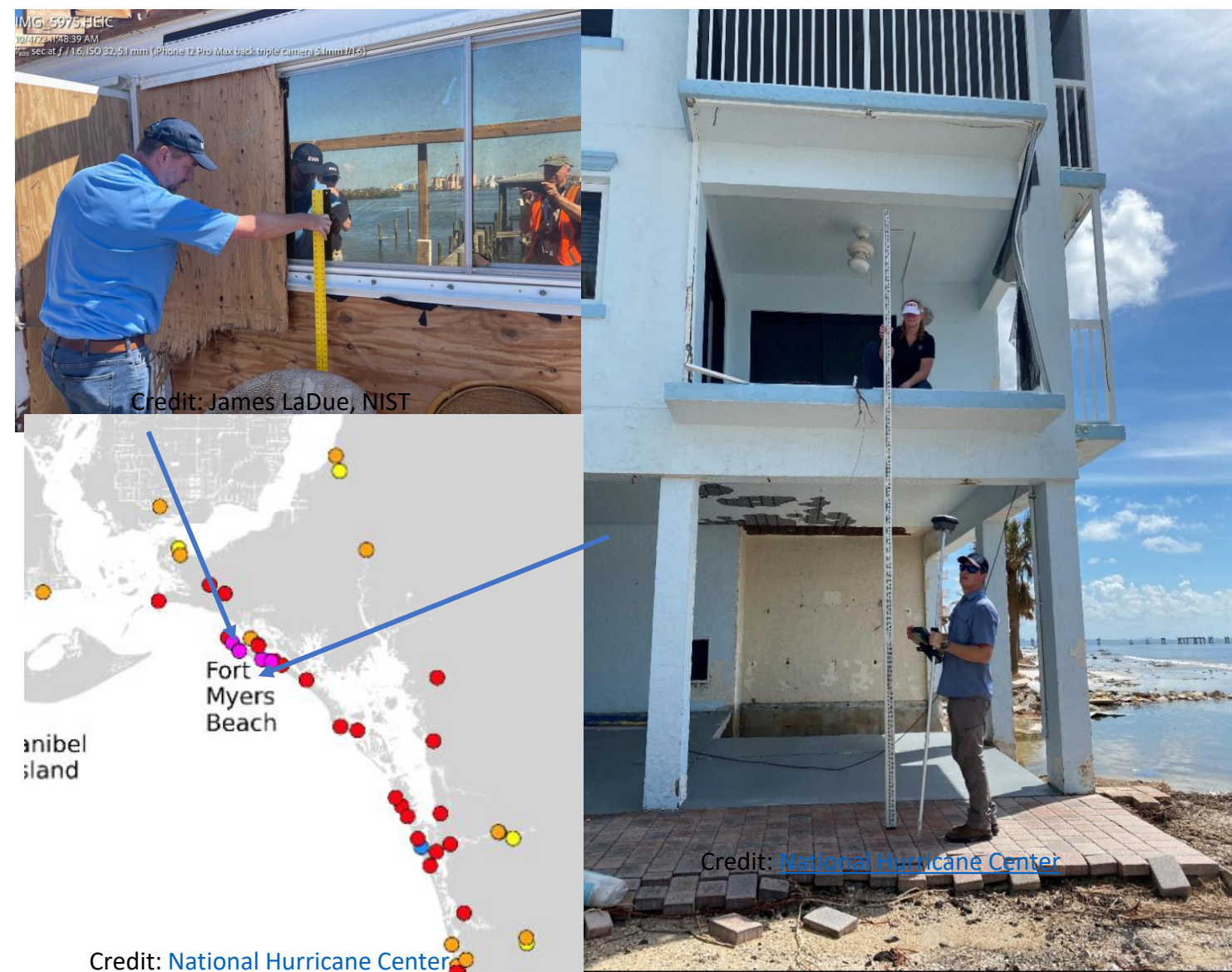
# Hurricane Ian Surge Water Levels

Water levels from USGS (left), NWS (right)



- Maximum surge height: 15 ft MHHW in Ft. Myers Beach
- Surge height > 7 ft MHHW as far south as Marcos Island
- 6-9 ft surge inundation from lower Cape Coral and Ft. Meyers, up the Caloosahatchee River

# Surge Damage Impact: Inundation



- Related to the most measured impact forcing – buoyancy
- Exceeded return intervals.
- Extensive guidance available in ASCE7.



# Other Surge Impacts



Credit: [Max Olson](#):

## Waves

No measurements during or after the storm

Conservative estimates are made with wide error bars

Relatively low confidence guidance in ASCE7 evaluating damaging debris



Credit: James LaDue, NIST

## Flow Velocity

No measurements during or after the storm

Conservative estimates are made with wide error bars

Relatively low confidence guidance in ASCE7 evaluating damaging debris



Credit: James LaDue, NIST

## Debris

Limited data collection during or after the storm

Includes loading and impacts

Relatively low confidence guidance in ASCE7 evaluating damaging debris

# Wind Impacts: newer residences



Credits: left – NOAA, right – NSF StEER

- Peak wind gusts ~125 mph, were ~25 mph below design levels.
- New housing, built to modern codes, had little visible wind damage.



# Wind Impacts: Roofing



Credit: James LaDue, NIST

Aluminum roof shingle damage in western Punta Gorda.

- Some residences suffered more significant roof damage.
- Possible causes:
  - Built to older codes
  - Poor application of modern codes
  - Poor maintenance

# Wind Impacts: other cladding damage

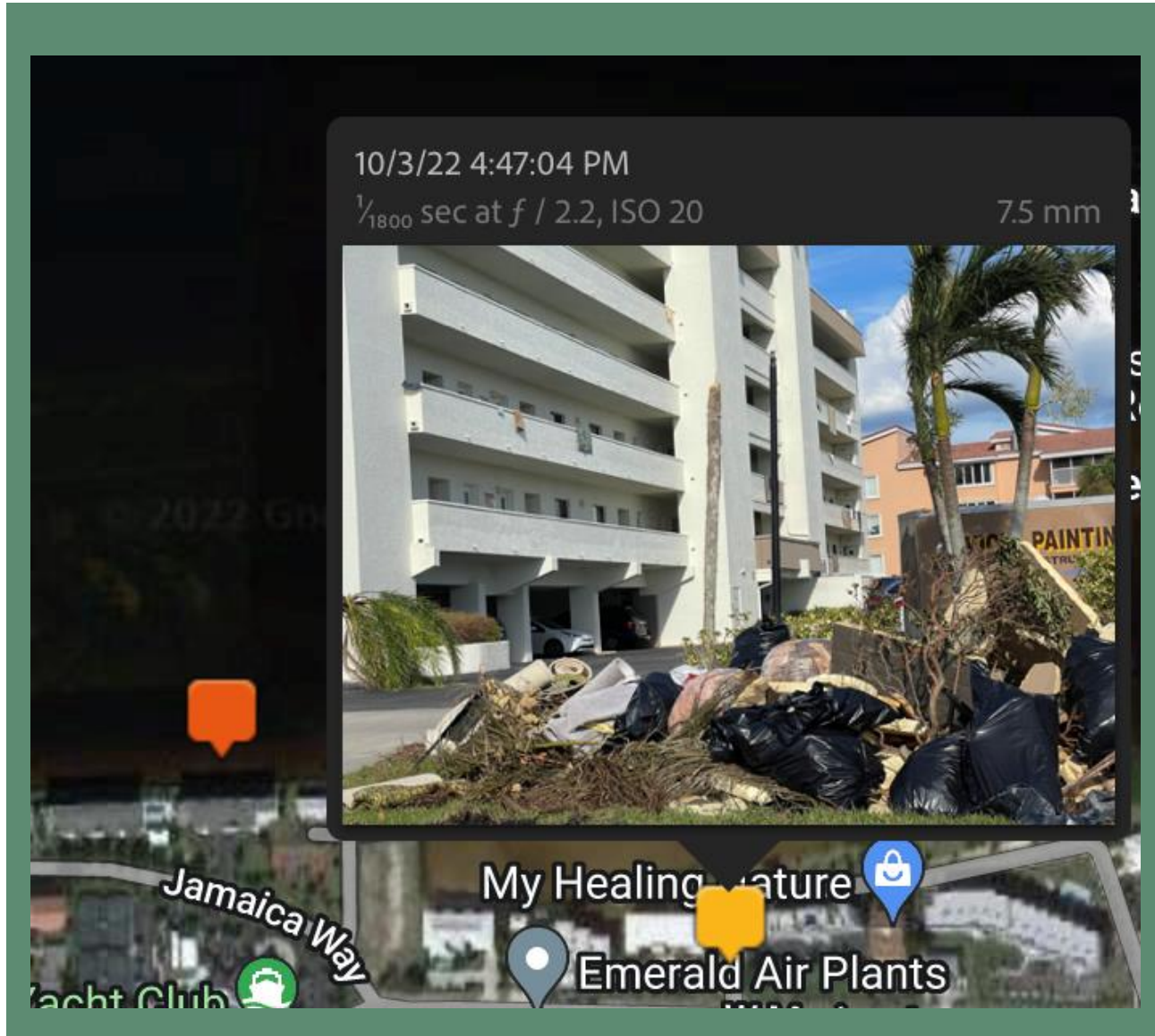


Credit: James LaDue, NIST

- Blown out window caused collateral damage to siding.



# Wind Impacts: Rainwater Intrusion



- Wind-induced rainwater intrusion damaged interiors content and finishes.
- Some building systems have little guidance for mitigating rainwater intrusion.



# Hurricane Ian NWIRP Study Goals



## Storm Surge

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Improve storm surge guidance for ASCE's standards and codes based on inundation, currents, waves and debris.

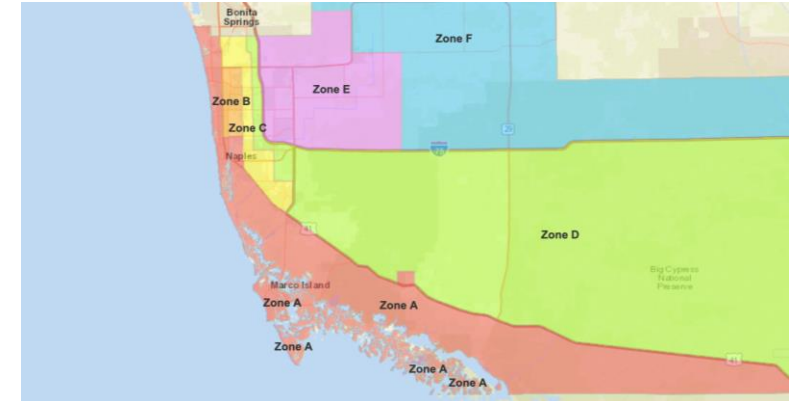


## Wind Effects

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Determine causes of wind damage and rainwater intrusion.

Document successes of improved codes in mitigating damage.

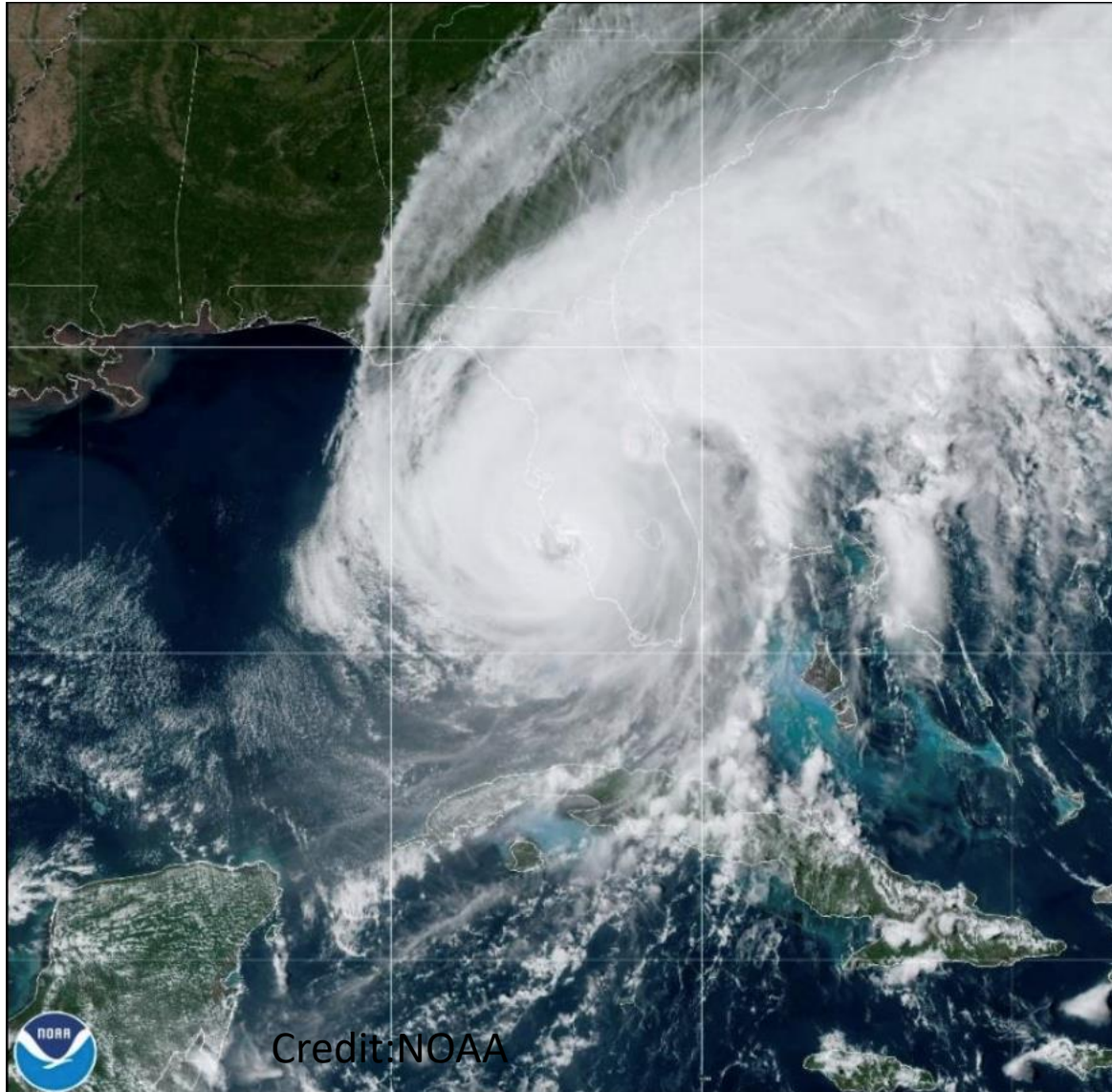


## Evacuation

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Determine why many residents did not evacuate leading to significant casualties.

# NIST Plan for an Ian NWIRP Study



- NWIRP study with a research-to-operations (R2O) process to improving codes and standards
- Funded as part of the \$40M disaster supplemental provided to NIST by Congress in December 2022



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**Questions?**